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Rhizospheric bacterial strain brevibacterium casei MH8a colonizes plant tissues and enhances Cd, Zn, Cu phytoextraction by white mustard

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Abstract

© 2016, Płociniczak, Sinkkonen, Romantschuk, Sułowicz and Piotrowska-Seget.Environmental pollution by heavy metals has become a serious problem in the world. Phytoextraction, which is one of the plant-based technologies, has attracted the most attention for the bioremediation of soils polluted with these contaminants. The aim of this study was to determine whether the multiple-tolerant bacterium, Brevibacterium casei MH8a isolated from the heavy metal-contaminated rhizosphere soil of Sinapis alba L., is able to promote plant growth and enhance Cd, Zn, and Cu uptake by white mustard under laboratory conditions. Additionally, the ability of the rifampicin-resistant spontaneous mutant of MH8a to colonize plant tissues and its mechanisms of plant growth promotion were also examined. In order to assess the ecological consequences of bioaugmentation on autochthonous bacteria, the phospholipid fatty acid (PLFA) analysis was used. The MH8a strain exhibited the ability to produce ammonia, 1-amin--cyclopropane-1-carboxylic acid deaminase, indole 3-acetic acid and HCN but was not able to solubilize inorganic phosphate and produce siderophores. Introduction of MH8a into soil sigNificantly increaSed S. alba biomass and the accumulation of Cd (208%), Zn (86%), and Cu (39%) in plant shoots in comparison with those grown in non-inoculated soil. Introduced into the soil, MH8a was able to enter the plant and was found in the roots and leaves of inoculated plants thus indicating its endophytic features. PLFA analysis revealed that the MH8a that was introduced into soil had a temporary influence on the structure of the autochthonous bacterial communities. The plant growth-promoting features of the MH8a strain and its ability to enhance the metal uptake by white mustard and its long-term survival in soil as well as its temporary impact on autochthonous microorganisms make the strain a suitable candidate for the promotion of plant growth and the efficiency of phytoextraction.

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Keywords

Brevibacterium, Heavy metals, PGPE, Phytoextraction, Sinapis alba L